

## Remarks

Claims 11 and 21-24 were rejected under § 103(a) for alleged obviousness based upon U.S. Patent 6,613,225 to Toyoda et al. in view of EP 1118385 to Kobayashi et al.

Claims 12-15 and 25 were rejected under § 103(a) for alleged obviousness based upon Toyoda et al., in view of Kobayashi et al. and further in view of U.S. Patent 6,030,526 to Porter.

In view of the clarifications and remarks set forth herein, it is submitted that all pending claims 13 and 21-24 are in condition for allowance.

### **A. Rejection of Claims 11 and 21-24 Under § 103(a) Must Be Withdrawn**

In support of this ground of rejection, the Examiner asserted:

Claims 11 and 21-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Toyoda et al. 6,613,225 in view of EP 1118385 Al Kobayashi. Toyoda et al. disclose (see col. 3 line 39 through col. 5 line 62, and col. 10 lines 5-57) a photocatalyst reaction apparatus substantially as claimed. The claims differ from Toyoda et al. by reciting that the protective layer contains lithium silicate. Kobayashi disclose (see col. 4 line 21 through col. 5 line 39, col. 10 lines 49-54, and Example 5) that it is known in the art to utilize lithium and sodium silicate as binders for attaching a photocatalyst to a substrate. It would have been obvious to one skilled in the art to modify the apparatus of Toyoda et al. by including lithium silicate in the protective layer in view of the teachings of Kobayashi, to aid in binding the photocatalyst to the substrate. With regard to claims 21-24, it is submitted that the teachings of Kobayashi as applied above appear to disclose the use of both lithium and sodium silicate, and a resin to form the binder. The specific weight %'s and emulsion utilized, would have been an obvious matter of process optimization to one skilled in the art, depending on the specific water treated and results desired, absent a sufficient showing of unexpected results.

Page 2 of the Office Action mailed March 30, 2004.

Since claim 11 has been canceled, the rejection of that claim is moot. As to claims 21-24, those claims have been amended to depend from claim 13, which has also been amended. Claims 21-24 all depend from claim 13 and so each claim contains the recitations of claim 13. Furthermore, these dependent claims recite additional aspects that are not taught or described by Toyoda et al. or Kobayashi et al. It is believed that claims 21-24 recite patentable subject matter for at least the following reasons.

Claim 13, as amended herein, recites a specific and unique reaction apparatus. Neither Toyoda et al. nor Kobayashi et al. teach or suggest the specific features of the reaction apparatus recited in claim 13.

The differences between Toyoda et al. and the presently claimed subject matter include the following. Toyoda et al. is silent as to the recitation in claim 13 that "the means for radiating ultraviolet rays provided in a second water tank is means for radiating ultraviolet rays of a long wavelength of 310 to 370 nm." By receiving irradiation with ultraviolet rays having a wavelength of 310 to 370 nm, the hydroxyl radicals or super oxides formed by radiation of ultraviolet rays of a medium wavelength of 170 to 260 nm are converted back into harmless water and oxygen, to obtain purified water. Please see page 10, line 20 to page 11, line 1, and page 24, line 24 to page 25, line 5 of the present application. This is a significant feature that Toyoda et al. entirely fails to teach or suggest.

Additionally, in the claimed reaction apparatus, ozone is formed by radiating air ultraviolet rays of a short wavelength of 183 to 184 nm before entering into a tank where water to be treated is mixed with ozone. On page 23, lines 11 to 26 of the present specification, there is a description in view of Fig. 15, "[i]n device 52 for taking air and radiating ultraviolet rays of a short wavelength...are radiated with an ultraviolet lamp into air... The ozone formed in a device for radiating ultraviolet rays of a short wavelength is mixed with water supplied with pump 51, and enters in tank 53. The water which contains ozone and is stored in tank 53 is then introduced into device 21A for radiating ultraviolet rays of a medium wavelength." Claim 13 specifically recites that the reaction apparatus comprises a tank for mixing ozone formed by "radiating ultraviolet rays of a short wavelength of 183 to 184 nm to air with water to be treated." Toyoda et al. entirely fails to teach or even suggest this feature, particularly with regard to the additional aspects recited in claim 13. Therefore, claims 21-24 which are all dependent from claim 13 and contain the recitations of claim 13, are readily distinguishable from, and nonobvious over, Toyoda et al.

Kobayashi et al. is entirely silent as to the specific features, particularly those noted above, recited in claim 13 for a reaction apparatus. Accordingly, claims 21-24 which are all dependent from claim 13 are readily distinguishable from, and nonobvious over, Kobayashi et al. Furthermore, these dependent claims recite additional aspects which taken in conjunction with the features of claim 13, are

simply not taught by the art relied upon for the present rejection. Accordingly, this ground of rejection must be withdrawn.

**B. Rejection of Claims 12-15 and 25 Under § 103(a) Must Be Withdrawn**

The Examiner contended in this regard:

Claims 12-15 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Toyoda et al. 6,613,225 in view of EP 1118385 Al Kobayashi as above, and further in view of Porter. The claims differ from the references as applied above by reciting that the apparatus comprises a water tank provided water introducing and discharging means, at least two water tanks in series including means for radiating ultraviolet rays, and a tank for mixing ozone. Porter disclose (see col. 1 line 40 through col. 5 line 31) that it is blown in the art to provide a water tank with a photocatalyst, and water introducing and discharging means, and to utilize at least two tanks in series with means for radiating ultraviolet rays and for mixing ozone with water. It would have been obvious to one skilled in the art to modify the references as applied above by including the recited tanks in view of the teachings of Porter, to aid in removing contaminants from water. The specific wavelength utilized in each of the tanks, would have been an obvious matter of process optimization to one skilled in the art, depending on the specific water treated and results desired, absent a sufficient showing of unexpected results.

Pages 2-3 of the Office Action.

Claims 12, 14, 15, and 25 have been canceled, and so, the rejection of these claims is moot.

The only remaining claim of the rejected claims at issue is claim 13. For the reasons previously set forth, claim 13, particularly as now amended, is patentable over the patents to Toyoda et al. and Kobayashi et al. The Examiner additionally cited a patent to Porter.

In Porter, oxygen flows into an annular chamber 16 between a reactor outer wall 26 and a porous wall 22. The pressurized gases pass through the porous wall 22 ("20" is an error) and exit into a flow chamber 24 in the form of small bubbles. At the inner surface of the porous wall 22, the swirling flow shears the bubbles from the wall, producing micron-sized bubbles in suspension. The small bubbles formed in the chamber 24 are radiated with ultraviolet light of a wavelength less than 200 nm (see col. 3, lines 17-56).

In the claimed reaction apparatus, air (oxygen) is radiated directly by ultraviolet light to produce ozone more efficiently; while in Porter, air bubbles are irradiated in suspension, where ultraviolet light is hindered from penetration. This is

a significant and patentably distinguishable feature of the apparatus recited in claim 13.

In addition, the patent to Porter fails to remedy the significant deficiencies of the collection of Toyoda et al. and Kobayashi et al. Porter entirely fails to teach or even suggest the aspects of claim 13 as now amended.

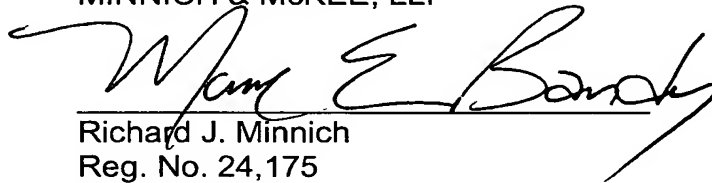
For at least these reasons, claim 13 is patentable over the noted art, and the present rejection must be withdrawn.

### C. Conclusion

In view of the foregoing, all of claims 13 and 21-24 are in condition for allowance. In the event the Examiner maintains any reservation as to the patentability of these claims, Applicants' attorney respectfully requests the Examiner to contact the undersigned by telephone.

Respectfully submitted,

FAY, SHARPE, FAGAN,  
MINNICH & McKEE, LLP

A handwritten signature in black ink, appearing to read "Mark E. Bandy", is written over a horizontal line.

Richard J. Minnich  
Reg. No. 24,175  
Mark E. Bandy  
Reg. No. 35,788  
1100 Superior Avenue, 7th Floor  
Cleveland, Ohio 44114-2579  
(216) 861-5582